Evaluation of BuyWrite and Volatility Indexes

Using the CBOE DJIA BuyWrite Index (BXD) and CBOE DJIA Volatility Index (VXD) for Asset Allocation and Diversification Purposes

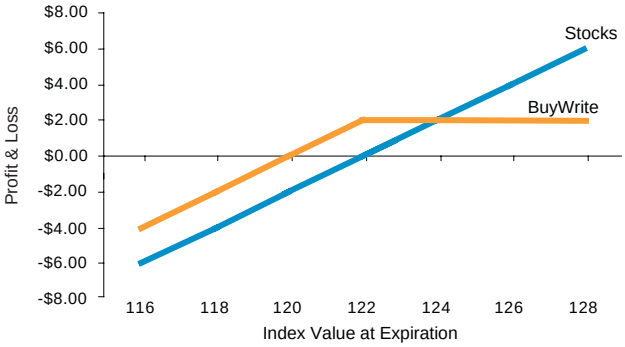
Fund Evaluation Group, LLC ***2007***

BuyWrite Strategy: Can it Generate Income and Lower Portfolio Volatility?

Introduction to the BuyWrite Strategy:

A "BuyWrite" strategy, also known as a "covered call," is an investment strategy where the investor buys a stock or a basket of stocks and writes (or sells) call options that cover the stock position. The advantage of this strategy is that the option premium cushions downside moves in an equity portfolio. The trade-off, however, is that the upside potential of the investment is truncated when the index moves above the option's strike price. Therefore, the BuyWrite strategy has outperformed stocks in neutral and bear markets and underperformed stocks in bull markets. The profit/loss profile of a BuyWrite strategy executed at a 122 strike price can be seen in Exhibit 1.

Exhibit 1: Profit & Loss Expectations for a BuyWrite Strategy
Example with the BXD index at 122



The BXD Index:

The CBOE DJIA BuyWrite Index (the "BXD℠" or the "BXD Index℠") measures the total rate of return of a hypothetical "covered call" strategy applied to the Dow Jones Industrial Average (the "DJIA"). This strategy consists of a hypothetical portfolio containing a "long" position indexed to the DJIA on which are sold a succession of one-month, at-the-money call options on the DJIA listed on the Chicago Board Options Exchange (CBOE) under the ticker symbol "DJX." The BXD covered call strategy requires that each DJX call option in the hypothetical portfolio be held to maturity, generally the third Friday of each month. The DJX index option contract is based on 1/100th (one-one-hundredth) of the current value of the DJIA. When DJIA is at 12,200, the DJX level should be near 122.

The DJIA is a price weighted average of 30 stocks designed to measure the returns of the U.S. stock market. For the purposes of this paper, reference is made to indexes with calculations that include reinvestment of dividends. The Russell 2000 Index is an index of approximately 2000 stocks weighted according to market capitalization that serves as a proxy for small capitalization U.S. stocks. The MSCI EAFE index measures the return of large capitalization stocks in developed international countries. The Lehman Brothers Aggregate Bond Index is a measure of the investment grade U.S. bond market, and the 3-Month U.S. Treasury Bill provides a proxy for a risk-free return on cash.

Exhibit 2: Growth of One Dollar
BXD vs. Equity Indexes*
(Monthly Data October 31, 1997 through November 30, 2006)

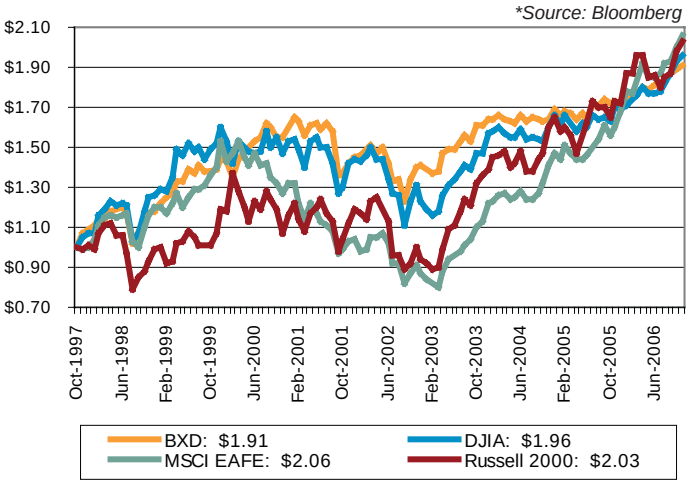


Exhibit 2: Beginning in October 1997, an investment of one dollar ($1) in each of the equity indexes would have grown to similar amounts, but the BXD growth was more stable.

Exhibit 3: Growth of One Dollar
BXD vs. Fixed Income*
(Monthly Data October 31, 1997 through November 30, 2006)

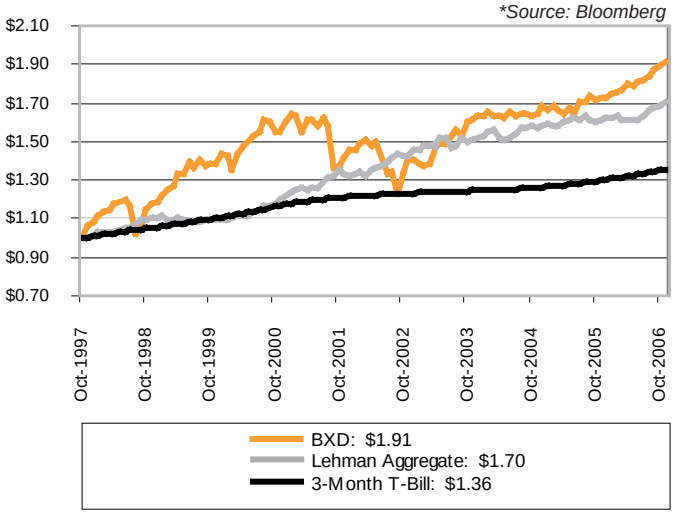


Exhibit 3: Relative to fixed income and cash, the BXD's asset growth was superior, yet more volatile.

The Fund Evaluation Group Study:

Fund Evaluation Group ("FEG") conducted an evaluation of the CBOE DJIA BuyWrite Index from a total portfolio perspective. We reviewed the complete performance history (October 16, 1997 through November 30, 2006) analyzing returns and risk in terms of standard deviation comparing the BXD to various equity and fixed income benchmarks. The BXD was initiated at a starting price of 100 on October 16, 1997. We analyzed the risk-adjusted returns by calculating the Sharpe ratio. FEG evaluated the impact BXD might have had on several different portfolios. For purposes of this study (unless otherwise noted), we used monthly returns calculated at month-end. Finally, FEG studied the impact of including an allocation to the CBOE DJIA Volatility Index ("VXD") in portfolios.

Exhibit 4: Annualized Returns
(Montly Data October 31, 1997 through November 30, 2006)

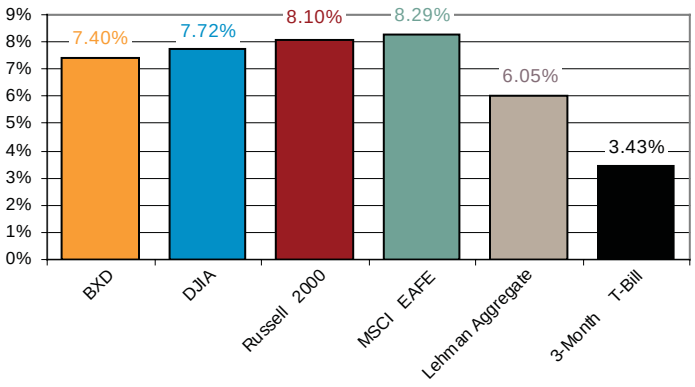
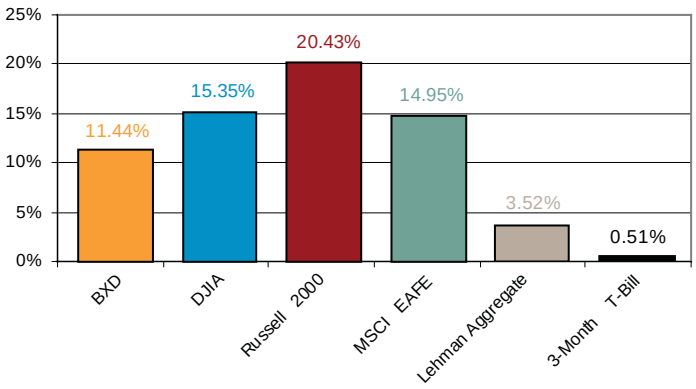


Exhibit 5: Annualized Standard Deviation
(Monthly Data October 31, 1997 through November 30, 2006)



Summary of Returns:

This study spans just over nine years of data, a time in which the annualized returns for the equity indexes were lower than their respective long-term historical averages. According to Ibbotson (2006), large cap stocks posted an annualized return of 10.4% from 1926 through 2005 and small cap stocks returned 12.6% over that same period. Over the period of this study, the DJIA advanced 7.7% and the Russell 2000 Index returned 8.1%. International stocks (MSCI EAFE Index) advanced 11.2% annualized since 1969 but returned 8.3% during this study period. During this period of positive but lower-than-average stock market returns, the BXD posted advances comparable to those of other equity indexes (Exhibit 4). Bond returns were more in line with long-term averages during the period of this study. Long-term government bonds advanced 5.5% and Treasury bills advanced 3.7% annualized since 1926, which is similar to the 6.1% return for the Lehman Brothers Aggregate Bond Index (comprised of intermediate and long-term bonds) and the 3.4% return for 3-Month T-Bills over the course of this study. During a somewhat normal performance period for cash and bonds, the BXD outperformed.

Summary of Risk:

The BXD posted returns similar to several equity indexes but exhibited significantly less volatility over the course of this study. The BXD's annual standard deviation was approximately 75% of that experienced by the DJIA and was only slightly more than half that of the Russell 2000. The period of study was modestly less volatile compared with the long term. According to Ibbotson (2006) the annual standard deviation of large cap stocks from 1926 through 2005 was 20.2%, and the small cap stock standard deviation was 32.9% over that same time period. Since 1969, the volatility of international stocks (MSCI EAFE Index) was 22.1%.

Volatility is not the only relevant measure of risk. Downside deviation illustrates the magnitude of the largest decline during the period of study. Even though the BXD performance data show a negative skew (Exhibit 8), the BXD's downside deviation (8.2%) was smaller than that of all three equity indexes, and as expected, larger than bonds (Lehman Brothers Aggregate Bond Index) and cash (3-Month T-Bills).

Exhibit 6: Annualized Returns vs. Risk
(Monthly Data October 31, 1997 through November 30, 2006)

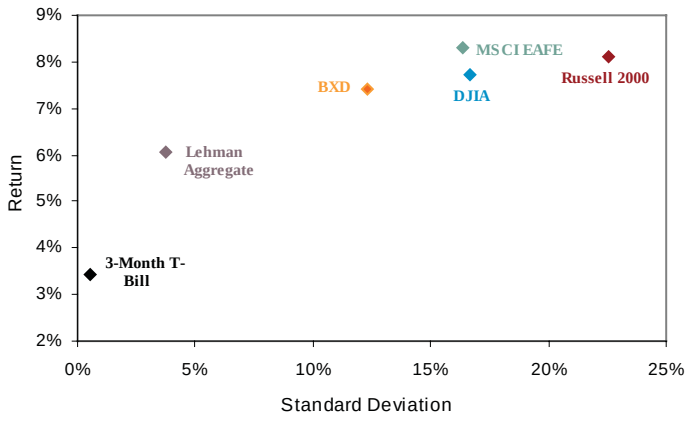


Exhibit 6: The graph above plots several indexes according to their respective risk and reward. Over the course of the study, the BXD posted annualized returns similar to equity indexes but experienced less volatility. The BXD's performance was superior to fixed income and cash, but exhibited greater volatility.

Exhibit 7: Annualized Sharpe Ratio
(Monthly Data October 31, 1997 through November 30, 2006)

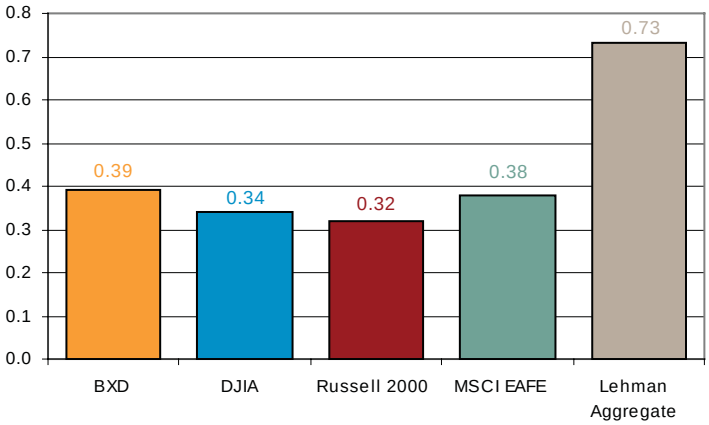


Exhibit 7: The Sharpe ratio is a measure of risk-adjusted returns. It is calculated by dividing the average return in excess of the risk-free rate by standard deviation. Over the course of this study, the BXD's Sharpe ratio was lower than bonds and international stocks but above large cap and small cap U.S. stocks. Despite only modest outperformance above the risk-free rate (3-Month T-Bills, 3.4% over the course of the study), the Lehman Brothers Aggregate Bond Index enjoyed the highest Sharpe ratio because its standard deviation was far lower than the other indexes.

Although the BXD's performance showed measurable levels of skew and kurtosis, previous BuyWrite index studies indicated that similarly constructed indexes were not materially affected by skew and kurtosis, making the Sharpe ratio a relevant measure of risk-adjusted returns.

Bonds exhibited a higher Sharpe ratio than stocks due to the lower than average returns for stocks over the course of this study. According to Ibbotson, the Sharpe ratio for stocks from 1926 through 2005 was 0.42 and the Sharpe ratio for long-term government bonds was 0.22 over the same period.

Exhibit 8: Supplementary Statistics
(Monthly Data Octtober 31, 1997 through November 30, 2006)

	Auto-Correlation	Monthly Skewness	Monthly Kurtosis	Annualized Compound Return	Annualized Excess Return over S&P 500	Annualized Standard Deviation	Annualized Downside Deviation	Annualized Sharpe Ratio
BXD	-0.01	-1.34	5.10	7.4%	0.9%	11.4%	8.2%	0.39
DJI	-0.03	-0.49	1.40	7.7%	1.3%	15.4%	10.1%	0.34
Russell 2000 Index	0.06	-0.43	0.76	8.1%	1.6%	20.4%	13.6%	0.32
MSCI EAFE Index	0.13	-0.55	0.52	8.3%	1.8%	15.0%	10.0%	0.38
Lehman Aggregate	0.07	-0.77	1.51	6.1%	-0.4%	3.5%	1.9%	0.73
3-Month T-Bills	0.97	-0.09	-1.40	3.4%	-3.0%	0.5%	0.0%	--

Exhibit 8: Autocorrelation illustrates the correlation of a series to the same series only shifted by one period (DeFusco 2001, p. 500). High numbers indicate greater consistency of performance from one period to the next. Skewness indicates the magnitude and direction of data distribution relative to the mean (DeFusco 2001, p. 138), and kurtosis is the degree of "peakedness" of a distribution (DeFusco 2001, p. 142). A high kurtosis distribution has a sharper "peak" and fatter "tails," while a low kurtosis distribution has a more rounded peak with wider "shoulders." The Annualized Compound Return is a geometric annualized mean of monthly returns (DeFusco 2001, p. 125). The S&P 500 annualized return over this period was 6.47%. Standard Deviation is a measure of dispersion of monthly returns that illustrates portfolio volatility (DeFusco 2001, p. 131). Downside deviation is a measure of the variability of negative monthly returns. Sharpe ratio does not consider skew or kurtosis in its calculation, but previous studies suggest that the performance of similarly calculated BuyWrite indexes is not materially affected by the negative skew and excess kurtosis (Callan 2006).

Call Premiums as a Source of Return:

Selling index options 12 times per year produces significant income. Whaley (2002) and Feldman and Roy (2005) demonstrated that implied volatility reflected in the price of S&P 500 options is often higher than realized volatility, suggesting that index calls trade at a persistent premium to their fair value.

The CBOE BXD call premiums, earned as a percentage of underlying value from October 17, 1997 to October 20, 2006, is plotted against the CBOE DJIA Volatility Index (VXD) (a measure of expected stock market volatility) in Exhibit 9. The average monthly premium since October, 1997 is 1.84%, an annualized rate of 24.46%. Premium levels are closely tied to volatility expectations; premiums rose sharply with volatility in the bull market of the late 1990s and through the sharp market decline in 2000–2002. Both premiums and expected volatility have since subsided to the levels observed in the early 1990s.

Exhibit 9: CBOE BXD Call Premiums and CBOE VXD Levels

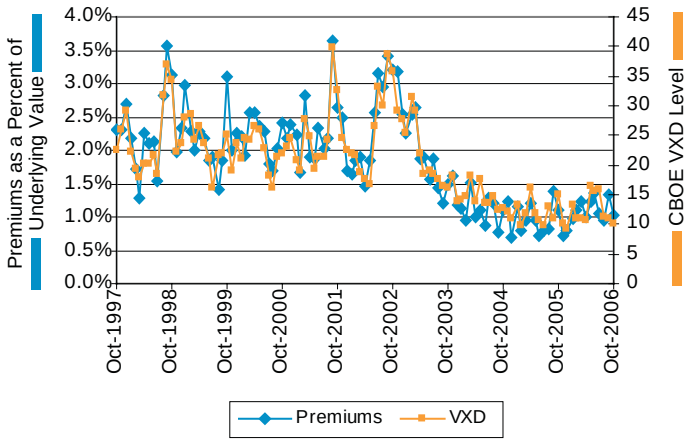


Exhibit 10: Portfolio Asset Allocation with Risk and Return
(Monthly Data October 31, 1997 through November 30, 2006)

	Portfolio Asset Allocations							Returns and Risk		
	BXD	DJIA	Russell 2000	MSCI EAFE	Lehman Aggregate	3-Month T-Bill	VXD	Annualized Return	Standard Deviation	Sharpe Ratio
(A-1) Aggressive	0%	40%	20%	20%	20%	0%	0%	8.04%	11.72%	0.39
(A-2) Aggressive with 10% BXD	10%	30%	20%	20%	20%	0%	0%	8.01%	11.23%	0.41
(B-1) Conservative	0%	25%	10%	10%	50%	5%	0%	7.23%	6.45%	0.59
(B-2) Conservative with 10% BXD	10%	15%	10%	10%	50%	5%	0%	7.17%	5.98%	0.63
(C-1) All Stocks	0%	50%	25%	25%	0%	0%	0%	8.26%	14.84%	0.33
(C-2) Stocks with 10% BXD	10%	40%	25%	25%	0%	0%	0%	8.25%	14.34%	0.34
(C-3) Stocks with 25% BXD	25%	35%	20%	20%	0%	0%	0%	8.15%	13.53%	0.35
(D-1) All Fixed Income	0%	0%	0%	0%	90%	10%	0%	5.79%	3.18%	0.74
(D-2) Fixed Income with 10% BXD	10%	0%	0%	0%	80%	10%	0%	6.00%	2.81%	0.92

Exhibit 10: The risk and return characteristics of various portfolios is shown above. Incorporating the BXD into these portfolios would have improved risk adjusted returns (Sharpe Ratio).

Exhibit 11: Efficient Frontier: BXD vs. DJIA in 10% Intervals
(Monthly Data October 31, 1997 through November 30, 2006)

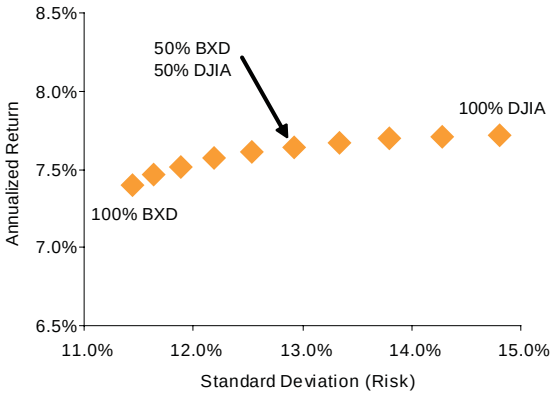


Exhibit 11: The graph above illustrates the tradeoff of allocating assets from one investment to the other. The combination of the two assets provided superior returns for each level of risk.

Exhibit 12: Volume and Open Interest

	Avg. Daily Volume (Jan.-Nov. 2006)	Open Interest (Nov. 2006)
Options on Dow Jones Industrial Average (DJX)	31,346	882,470
Options on Diamonds (DIA)	33,945	1,466,466
Futures on the CBOE DJIA Volatility Index (VXD)	159	1,670

Source: CBOE

Can Long Volatility Futures Smooth Portfolio Returns?

Impact on Volatility During Market Advances and Declines:

Recall from Exhibit 9 that the CBOE DJIA Volatility Index (VXD) has tracked closely with call option premium prices. Option price premiums have increased substantially during stock market declines as evidenced by the large average VXD advance corresponding with large DJIA average declines (Exhibit 13). However, the VXD did not decline with the same magnitude during large stock market advances. The VXD and the Dow Jones Industrial Average were inversely correlated (-0.62) over the course of this study, but the larger VXD advances during market declines indicate that it has been more reactive to stock market declines than stock market advances.

Exhibit 13: Volatility Index Advances as Stock Index Declines
(Monthly Data October 31, 1997 through November 30, 2006)

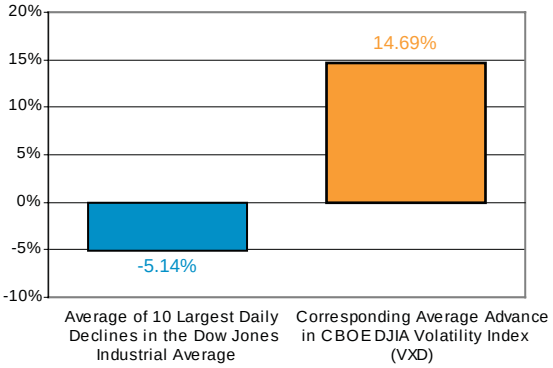


Exhibit 13: Option price premiums have increased substantially during stock market declines as evidenced by the large average VXD advance corresponding with large DJIA average declines.

Exhibit 14: Efficient Frontier: DJIA vs. VXD in 5% Intervals
(Monthly Data October 31, 1997 through November 30, 2006)

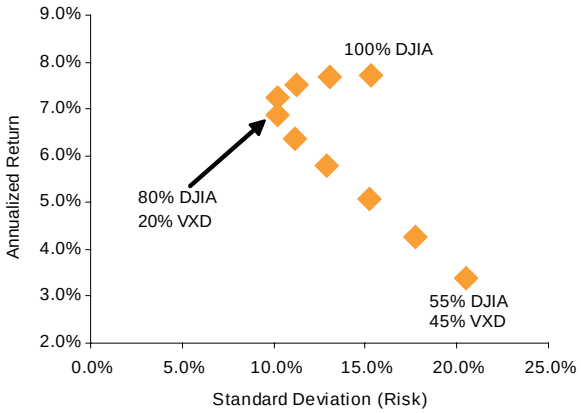


Exhibit 14: Although a portfolio comprised of DJIA and VXD would have experienced lower returns with the addition of greater amounts of VXD, the risk/return tradeoff was improved by the addition of VXD in amounts up to between 15% and 20%, but begins to decline at VXD amounts of 20% and larger.

Exhibit 15: Portfolio Asset Allocation with Risk and Return
(Monthly Data October 31, 1997 through November 30, 2006)

	Portfolio Asset Allocations							Returns and Risk		
	BXD	DJIA	Russell 2000	MSCI EAFE	Lehman Aggregate	3-Month T-Bill	VXD	Annualized Return	Standard Deviation	Sharpe Ratio
(E-1) Stocks +25% BXD +5% VXD *(Compare with C-3 in Exhibit 10)*	25%	30%	20%	20%	0%	0%	5%	8.08%	11.10%	0.42
(E-2) Fixed Inc. +25% BXD +5% VXD *(Compare with D-2 in Exhibit 10)*	10%	0%	0%	0%	75%	10%	5%	5.69%	2.65%	0.85

Exhibit 15: Can be compared with Exhibit 10. Please note that this Exhibit refers to the VXD spot index, and that VXD futures do not perform exactly as the VXD spot index does.

Gaining Exposure to the VXD through Futures:

Adding a 5% VXD allocation to the C-3 portfolio in Exhibit 10 (E-1 in Exhibit 15) showed a Sharpe ratio increase from 0.35 to 0.42. The returns of this new portfolio were slightly lower, but the standard deviation was significantly lower. Contrarily, the impact of adding 5% VXD to the D-2 portfolio in Exhibit 10 was not positive. These numbers indicate that a small allocation to the VXD might have improved portfolios with a large allocation to equities, but might not have been as effective for portfolios with allocations to bonds and cash. Volatility as a tool for asset allocation is a concept worth considering because of the potential it has to improve the risk-adjusted returns of diversified portfolios. Gaining exposure to volatility can be achieved through futures contracts. Futures on the CBOE DJIA Volatility Index (VXD) began trading on the CBOE Futures Exchange on April 25, 2005.

Summary

The Fund Evaluation Group study uncovered the following key findings in its study of 109 months of performance of various indexes:

- Over the course of the study, the BXD exhibited similar performance to the stock indexes while experiencing less volatility.
- BXD returns were superior to bonds and cash but were more volatile.
- Incorporating an allocation to the BXD in either an aggressive or conservative portfolio could have improved the risk-adjusted returns of that portfolio (Sharpe ratio).
- Adding an allocation to volatility through the VXD could have reduced the volatility of an aggressive portfolio without materially affecting returns.

References:

Callan Associates, Inc. (2006) "An Historical Evaluation of the CBOE S&P 500 BuyWrite Index Strategy," (available at www.cboe.com/BXM) p. 3.

Feldman, Barry and Dhruv Roy (Summer 2005) "Passive Options-Based Investment Strategies: The Case of the CBOE S&P 500 Stocks BuyWrite Index." *The Journal of Investing*, pp. 66–83.

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Whaley, Robert (Winter 2002) "Risk and Return of the CBOE BuyWrite Monthly Index." *The Journal of Derivatives*, pp. 35–42.

Disclaimers and Notices:

Fund Evaluation Group, LLC provides objective investment advice and outsourced asset management to assist institutional investors in achieving their investment decisions. With nearly 20 years of experience, we assist clients with asset allocation & portfolio construction, investment manager due diligence & searches, and enhance their fiduciary oversight.

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